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SUBJECT—

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A REPORT ON THE CAUSE OF INJURY TO YOUNG WHITE PINE REPRODUCTION IN THE CATALOOCHEE DISTRICT OF THE GREAT SMOKY MOUNTAINS NATIONAL PARK

by
R. A. St. George

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Agricultural Research Center
Beltsville, Maryland
November 25, 1947

To: Evenden and Wygant

From: R. A. St. George, Entomologist,
Forest Insect Investigations (Through F. C. Craighead)

Subject: Pineus pinifoliae injury to white pine reproduction

At Dr. Craighead's suggestion, the enclosed report is being forwarded to you for review and comment. You may retain the report for your files if you so desire.

R.A.St.George

Enclosure

A REPORT ON THE CAUSE OF INJURY TO YOUNG WHITE PINE REPRODUCTION IN THE CATALOOCHEE DISTRICT OF THE GREAT SMOKY MOUNTAINS NATIONAL PARK

By R. A. St. George, Bureau of Entomology and Plant Quarantine

Cause and Damage

During early September, 1947, Ranger J. B. Light of the National Park Service, Cherokee, North Carolina, collected samples of young white pine reproduction, the terminals of which were in a weakened and dying condition, and forwarded them through Dr. E. Richard Toole, Division of Forest Pathology, Bureau of Plant Industry, Soils and Agricultural Engineering, Southeastern Forest Experiment Station, Asheville, North Carolina, to Dr. F. C. Craighead at Beltsville, Maryland, for determination. The material was collected in the Cataloochee District of the Great Smoky Mountains National Park where considerable damage was in evidence. In transmitting the specimens Dr. Toole stated that in many cases the twigs were completely covered with what appeared to be either aphid skins or scales. They were referred to the writer by Dr. Craighead and later submitted to Miss L. M. Russell of the Division of Insect Identification of this Bureau for determination.

The writer had an opportunity to visit the Cataloochee District on October 3 in company with Mr. W. L. Savage, Mr. Light and the resident Ranger, Mark Hannah, and made first-hand observations of the affected pines. It was observed that serious damage had been caused to young reproduction about 20 feet in height on which up to 40 percent of the current growth had been affected and killed. Dead nymphs, apparently of aphids, were found encrusted on the stems of the current

growth, also the needles were found to have many dead winged adults adhering to them. They were lined up one behind the other on the needles with their heads facing toward the bundle sheath. Similar injury to the terminal growth was noted on the lower branches of nearby mature pines. Ranger Hannah had observed that the terminals began to die around July 15.

In addition to the above pines, the nearby nursery was inspected. It is composed of 8- to 9-year old white pine stock which has attained a height of about six feet. The same type of injury was observed there, but it was less extensive than in the trees first examined. In some cases the nymphs were found only about the base of the current growth. In addition, a few dead winged adults were observed on the terminals.

Upon the writer's return to Beltsville, Miss Russell's determination of the first lot of material was available. It was as follows: "Chermidae: Pineus sp., early nymphs only, cannot place further without adults."

The second lot of insects, including both nymphs and winged adults, were taken from the terminal twigs. They were submitted on October 7, and on the 29th the following determination was received: "Chermidae: Pineus pinifoliae (Fitch)." Inasmuch as different species of aphids and chermids have been found associated at the same time on the same host, the writer asked Miss Russell if it could be assumed that the nymphs and winged adults in this case represented the same species. While she could not be certain, she thought the assumption could be made. Thus, it appears that the insect responsible for the injury is

one of the chermids, Pineus pinifoliae (Fitch). This insect is not a typical aphid although it has been called the "pine leaf aphid", also a "spruce gall aphid". It is closely related to the pine bark aphid, Pineus strobi (Hartig), formerly known as Chermes pinicortisis Fitch, and the spruce gall aphid or louse, Chermes abietis Kalt.

Information Concerning the Importance and Biology of Pineus pinifoliae (Fitch)

The pine-leaf chermid Pineus pinifoliae (Fitch) occurs quite generally throughout the United States and in Canada. It attacks western white pine and several species of spruce in the West and in the East is known to attack red and black spruce as well as white pine, but apparently does not infest white spruce. Some of its investigators are Annand, P. N. (1928, Stanford Univ. Pub. Biol. Sci., 6(1):93); Patch, E. M. (1909, "The pine-leaf and the green-winged Chermes", Me. Agr. Expt. Sta. Bul. 171); Balch, R. E. and L. S. Hawbolt (Report of Forest Insect conditions in Nova Scotia in 1942, p. 52, and in a similar report for 1943, p. 52, Dept. Lands and Forests, Halifax, N. S., Canada).

In Canada some 100 square miles of white pines were affected in one outbreak. The needles were clustered with winged adults and the new shoots with the "sisterns" larvae. In another outbreak area, after 4 years considerable damage was caused and the affected shoots turned brown over most of the trees. Although a reduction in growth was noted in the latter case, only a few trees were found that had died. Most of the injury seems to have occurred where red spruce and white pines were grown together. Galls are formed on the former,

and the current growth of the latter becomes weakened. Some of the smaller trees eventually die if attacked for 3 or 4 years in succession.

This chermid has also been found causing considerable damage to young western white pine reproduction (10-12 years old) in Idaho and Montana. It may be of interest to mention here that our files reveal this insect was taken from dying terminals of eastern white pines in the Cataloochee District of the Great Smoky Mountains National Park in June 1939. Specimens submitted by Dr. B. H. Wilford of this office, Asheville, N. C., were determined as this species.

The life history of this chermid is complicated and as yet is not fully known. Balch reports that two winged and three wingless adult generations occur and only one of them has two sexes. It migrates in the late spring or early summer from a spruce gall to the new growth on white pine. Both Patch and Annand have observed this transfer from one host to another. In Maine, Patch reports the adults seek pine from about the middle of June to July 3 and lay their eggs in batches of about 100 on the needles. Annand took alates emerging from spruce galls and after placing them on white pine observed them deposit eggs on the needles on July 4 in Oregon. The eggs hatch in about eight to ten days. The young larvae migrate to the new shoots, pierce the tissue with their long hair-like stylus and settle there. When numerous they give the shoots a yellowish, sickly appearance. They produce a flocculent waxy secretion which makes their presence discernible. However, another species, the pine bark aphid (Pineus strobi) is also frequently present and in such numbers as to cover almost the

entire trunk with a white fluffy wax. The young of these and other closely allied forms look much alike superficially, and even under the microscope are difficult to distinguish. Often a sooty mold develops on such twigs. So far, all of the nymphs found in the late fall in the present study have been dead. Also the winged adults seem to die shortly after they have deposited their eggs. Just how these chermids return from white pine to spruce is still unkown.

According to Annand, the spruce gall formed by this insect differs from that formed by all other known chermids. It is readily recognized by the flattening of the entire needle, rather than by the enlargement of the basal half alone. The needles uniformly taper to the tip, forming a scale, behind which one, or possibly two larvae can be found. The stem is not particularly increased in size in the affected portion. The gall is cone-shaped and is usually purple with the edges of the scales greenish when young and later almost entirely green. When the gall opens, it does so by the scales flaring out from the stem, leaving the deformed chambers entirely open. It then becomes reddish-brown. Some of the scales frequently drop off and the end of the twig dies.

The Control of Pineus pinifoliae

Tests conducted by the personnel of this Division for the control of this chermid on western white pine reproduction indicate that it is readily checked by spraying the young nymphs on the new growth during the early summer, either (1) with a mixture of derris powder and sulfonated caster oil, or (2) with nicotine sulfate and a white oil emulsion such as Volck. No subsequent injury was observed on the foliage. Their formulations are as follows:

(1) Sulfonated castor oil or white oil emulsion - 2 tablespoonfuls
Derris powder (containing 4% rotenone) - 5 level "
Water - 3 gallons

First add the sulfonated castor oil or white oil emulsion to the water. With a small quantity of this liquid mixture make a uniform paste with the derris powder. Then stir the paste into the full quantity of liquid.

(2) White-oil emulsion (as Volck or Verdol) - - 1/2 pint
Nicotine sulfate (40% nicotine) - - - - - - - 4 teaspoonfuls
Soap flakes - - - - - - - - - - - - - - - - - - 1/4 pound
Water - 3-1/4 gallons

First dissolve the soap flakes in hot water and then stirs in the emulsion and the nicotine sulfate.